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TRANSACTIONS

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OF LONDON

VOL. 90. 1940.

SIMULIIDAE (DIPT.) FROM BRITISH GUIANA AND THE LESSER ANTILLES

By John SMART, Ph.D.

(*Department of Entomology, British Museum (Natural History)*.)

WITH PLATES 1 TO 4 AND THREE FIGS. IN THE TEXT.

(Manuscript received 5.vii.1939.)

(Read 7th February, 1940.)

PINTO (1932) in his review of the SIMULIIDAE of South and Central America states that two species have been recorded from British Guiana, one from St. Vincent and two from Trinidad. In the course of an expedition to British Guiana, Trinidad and some of the Lesser Antilles made, in the summer of 1937, by Dr. O. W. Richards and his party of which I was a member, specimens of SIMULIIDAE were collected in British Guiana, Trinidad and Tobago. In working these out and in examining the collection in the British Museum it has been found that the species found or recorded in British Guiana and the Lesser Antilles are seven from British Guiana, three from Trinidad, one from Tobago, one from Montserrat and one from St. Vincent.

Unfortunately Pinto (1932) in his review of the family, gave no keys to the species. Lutz (1910) gave a key to the species recorded by him in Brazil, but this key is almost useless for the fauna of the Guianas and the neighbouring parts because it does not include any of the species from Central America and the Antilles whence several species have been described since the publication of Lutz's paper.

Lutz (1928) recorded eight species of SIMULIIDAE from Venezuela, and Pinto (1932) increased this number to ten, but neither author gave a key. Surcouf and Rincones (1911) in their paper on Venezuelan Diptera mention twenty-nine species, but it seems that they were dealing with species that they thought might be found in the region rather than with those known to occur. Knab (1914) published a paper on the SIMULIIDAE of Peru, and Edwards (1931) published on the SIMULIIDAE of Patagonia and South Chile, both of which regions are probably faunistically remote from the Guianas and the Antilles. Most of the other writings on the SIMULIIDAE of the regions under discussion consist of isolated notes and descriptions of species.

In working out the material collected by Richards and myself cognisance was taken of all the species actually recorded from the Guianas, Venezuela and the Lesser Antilles. Certain other species from Central America were considered as were some of the Brazilian and other South American species. In general, however, species, originally described from outside the area, that have not been recorded as occurring within it, have been omitted since their inclusion would have eventually involved the consideration of the whole Central and South American fauna, a task which must be deferred.

In the key to the females, which is presented below, all the species recorded in the area have been included, with a few additional ones that it seemed might perhaps be found at a later date. Wherever possible the key has been made using characters given by the original authors in their descriptions of the species. The key aims at being a practical one and does not attempt to express the phylogenetic relationships of the species.

Those who may wish to go further into the distribution, classification, etc. of the SIMULIIDAE of Central and South America should commence with the papers of Pinto (1932),[1] Edwards (1931) and Orfila (1939) and work backwards from these. Attention should be paid to Malloch (1914) and Dyar and Shannon (1927) on the general classification of American SIMULIIDAE. Other references, apart from those mentioned in the notes on the species, will be found at the end of this paper. Bequaert (1934) has given an extensive bibliography.

The SIMULIIDAE are of economic importance. When present in large numbers their bites can cause so much pain and irritation that both man and animals may have to cease work. They are also the proven transmitters of parasitic nematode worms of the genus *Onchocerca* in both the Old and New World. Recently both Donovan (1939) and Giglioli (1939) have pointed out that the problem of controlling *Simulium* must be considered in relation to any large-scale settlement of the hinterland of British Guiana.

I am indebted to Professor P. A. Buxton of the London School of Hygiene and Tropical Medicine, to Professor R. M. Gordon of the Liverpool School of Tropical Medicine and to Mr. B. Jobling of the Wellcome Research Institution for kindly lending me, for examination, material of various species of S. American *Simulium* deposited in the collections at their laboratories.

Key to *Simulium* (females only).

1. Dorsum of thorax yellow, with or without narrow silver stripes . . . 2.
–. Dorsum of thorax otherwise . . . . . 7.
2. Dorsum of thorax with longitudinal silvery or white stripes . . . . 3.
–. Dorsum of thorax without such stripes . . . . . 5.
3. 2 such silvery stripes on thorax . . . . . 4.
–. 4 such stripes . . . . . *samboni* Jennings, p. 8.
4. Femora and tibia darkened distally . . . . . *ochraceum* Walker, p. 7.
–. Femora yellow, tibia of first and second legs infuscated, tibia of third leg dark brown . . . . . *antillarum* Jennings, p. 4.
5. Sides of thorax and abdomen yellow with a certain degree of infuscation *dinellii* Joan, p. 4.
–. Sides of thorax and abdomen brownish showing only traces of a yellow tinge . . . . . 6.

[1] It should be noted that Pinto in preparing his paper, published in 1932, apparently was not able to include the species described by Edwards in his paper published in 1931. Pinto's long and valuable paper presumably had to go to press before Edwards' paper became available.

6. Hind femora pale . . . . . *perflavum* Roubaud, p. 7.
–. Hind femora dark . . . . . *rubrithorax* Lutz, p. 8.
7. Thorax showing a marked pattern on the dorsum. The pattern due to brightly iridescent areas of a varying extent on a dark ground-colour. The insect has to be moved in the light fully to appreciate the pattern and should be viewed beneath the binocular microscope with its head away from the observer and with the light coming on to the specimen from in front, or slightly to one side, of the microscope . . . . . 8.
–. Thorax plain, all one ground-colour. A pearly pollen may be present on the dorsum which may even give a shifting iridescence when the incidence of the light is altered. There is, however, no distinctive pattern beyond certain indistinct longitudinal dark stripes caused by interruption of the pollenosity. Small bright metallic hairs may be present . . . . 15.
8. Dorsum of thorax chocolate brown with a pearly-blue ornamentation; a very small species. . . . . *limbatum* Knab, p. 6.
–. Ground-colour of dorsum of thorax dull black with silvery iridescent marking on it . . . . . 9.
9. Abdomen with silvery iridescence on some part of it . . . . . 10.
–. Abdomen without any iridescent markings. . . . . 14.
10. Iridescence on some of the abdominal segments in addition to the first visible one . . . . . 11.
—. Only the first visible segment with iridescence . . *sanguineum* Knab, p. 9.
11. Iridescence in the form of two green-gold bands on the dorsum of the thorax . . . . . *paraguayense* Schrottky, p. 7.
—. Iridescence on the dorsum of the thorax silvery . . . . . 12.
12. The silvery iridescence on the dorsum of the thorax in the form of two large " commas " with heads towards the front . *incrustatum* Lutz, p. 6.
—. The silvery iridescence much more extensive, giving the appearance of the dorsum of the thorax having been entirely covered with it, but that it has been removed in certain places to produce the effect of a median dark stripe and, on either side, a lateral dark stripe none of which actually reaches either the anterior or the posterior margins of the dorsum . . 13.
13. Dorsum of the thorax with the median dark mark narrowing posteriorly and the lateral ones not meeting behind the termination of the median stripe . . . . . *amazonicum* Goeldi, p. 4.
—. Dorsum of thorax with median mark almost bilobed posteriorly and lateral marks passing round its termination and meeting . *versicolor* Lutz, p. 10.
14. Each silvery stripe, anteriorly, narrower than the median dark area between it and the stripe on the other side. Bases of the anterior abdominal segments opaque velvet black . . . . . *quadrivittatum* Loew, p. 8.
—. Each silvery stripe, anteriorly, as broad or broader than the median dark area between it and the stripe on the other side. The opaque areas on the anterior abdominal segments are constricted and formed into spot-like patches . . . . . *haematopotum* Malloch, p. 6.
15. Legs entirely yellow except for a slight darkening of the tarsi of the fore-legs . . . . . *exiguum* Roubaud, p. 4.
—. Legs otherwise . . . . . 16.
16. Legs reddish-yellow with only the tarsi black . . *tarsale* Williston, p. 9.
—. Legs otherwise . . . . . 17.
17. 2nd and 3rd pairs of legs all dark in colour with only a slight trace of light colour on the bases of the tarsi . . . . . 18.
—. Legs otherwise, *i.e.*, with dark and light markings in addition to darkened tarsi . . . . . 19.
18. Complete absence of any marks or pattern on the dorsum of the thorax, which is, however, covered with fairly widely spaced-out short scale-like golden hairs . . . . . *lugubre* Lutz, p. 7.

—. Thorax as in *lugubre* but shiny and with normal hairs not scale-like and golden . . . . . *metallicum* Bellardi, p. 7.
19. Legs dark brown (black) and white . . . . . *placidum* Knab, p. 7.
—. Legs dark brown and yellow . . . . . 20.
20. Thorax black with a slight shiny grey pollinosity . *subnigrum* Lutz, p. 9.
—. Thorax dull black with short golden scale-like hairs over its surface *guianense* Wise, p. 4.

Simulium amazonicum Goeldi.

1905, *Os mosquitos no Para* : 138.

This species is recorded from Brazil, Paraguay, Peru, British Guiana and Venezuela. It is represented in the British Museum collection by specimens from British Guiana and the Amazons.

Lutz (1917) figured the adult and Lutz (1928) the adult, the pupa and the larva.

The type is, presumably, in the Goeldi collection in Berne.

Simulium antillarum Jennings.

1915, *Proc. ent. Soc. Wash.* **17** : 200.

The localities from which the type series was collected were St. Croix (D.W.I.) and Jamaica (B.W.I.). It is represented in the British Museum collection by specimens from Jamaica and Montserrat (Woodlands, sucking human blood, 20.ix.1938). Jennings described both the male and the female, and his types are, presumably, in the U.S. National Museum, Washington. He stated that it was reared from pupae but does not describe them.

Simulium dinellii Joan.

1913, *Bol. Min. Agric. Argent.* **14** : 363.

The original description is fairly detailed and the insect is figured. It has been recorded from the Argentine and Peru. The British Museum collection contains specimens from Argentina (Jujuy, xi.1938) and Bolivia (Villa Montes).

The type locality is in the Argentina and the type may have been deposited in the Museum at Buenos Aires.

Simulium exiguum Roubaud.

1906, *Bull. Mus. Hist. nat. Paris* **12** : 108.

This species has been recorded from Guatemala and Venezuela, the latter being the type locality. There is one specimen which is probably a paratype in the British Museum collection, determined by Roubaud, from the type locality. The type is presumably in the Paris Museum.

Simulium guianense Wise.

1911, *Timehri* (3) **1** : 252.

Wise states that this species is known to the natives in British Guiana as the " Itanimi fly " and is distinguished by them from the " Pium," which Wise identified as *S. amazonicum* Goeldi. The specimens from which the original description was made were taken on the Essequibo River and its higher branches including, if the labels on Wise's specimens in the British Museum, which are not Wise's original labels, are correct, the Rupununi River.

Although he does not state so in his account of *S. guianense*, Wise apparently sent specimens of this species to the British Museum and the Liverpool School of Tropical Medicine. All the material from these two institutions has been examined in the course of the preparation of this paper and the conclusion

reached that the single specimen at the Liverpool School, and the four specimens in the British Museum, are to be regarded as cotypes. One of the last four is now hereby selected as the lectotype and has been labelled as such, and in consequence the other specimens now rank as paratypes. Wise in his description of the species is somewhat misleading when he describes his flies as " of a light silvery gray colour." This impression is due to the fact that the dorsum of the thorax is covered with short scale-like golden hairs which can, however, only be appreciated as such when the specimens are examined under the binocular microscope. Apart from this, Wise's description, especially of the legs, enables the insect to be identified.

Specimens of *S. guianense* were taken by me when apparently about to bite,

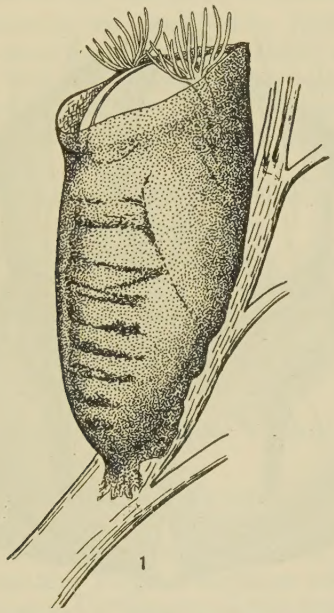

FIG. 1.—*S. guianense*, pupa and cocoon.

on the Kaieteur savannah and at the portages at Amatuk and Warratuk falls on the Potaro River during the first week of September 1937.

Imagines were also obtained from pupae taken on the leaves of species of Podostemaceae collected in the water in the Amatuk and Warratuk falls and in the water at the lip of the Kaieteur Fall itself. These plants grow on the bare rock in places that are completely dry during the dry season and completely submerged during the wet season. They only grow in places where the current is rapid to torrential. In some places the growth of the plants is almost moss-like, while in other places frond-like leaves that trail in the water, and are over six feet in length, are produced. When the water recedes in the dry season the leaves rot away very rapidly and the stumps of the plants, now dry and exposed on the rocks, burst into flower. The pupae and the larvae of *S. guianense* were found on the submerged leaves of these plants in places where the water was flowing with considerable force. They were found at depths varying from a few inches to a foot and a half; the force of the water prevented leaves being collected from greater depths. The pupa and its cocoon are shown in fig. 1,

and the male genitalia in fig. 2. Since Wise described the female only, the specimen of which the genitalia are here figured may be regarded as the allotype.

Simulium haematopotum Malloch.

1914, *U.S. Dept. Agric. Bur. Ent. Tech. Ser.* **26** : 62.

Malloch records this species from Mexico and Cuba. It has also been recorded from Guatemala and Porto Rico. The British Museum collection has specimens from Mexico and Apoteri, Essiquibo (ix.–x.1926), with a note to the effect that they are called " Cabowra flies."

I collected specimens of this species at Warratuk and Tukeit on the Potaro River (31.viii.1937), where it was biting members of the party, and when biting and by sweeping, on the savannah at the Kaieteur Fall (4–6.ix.1937). It was

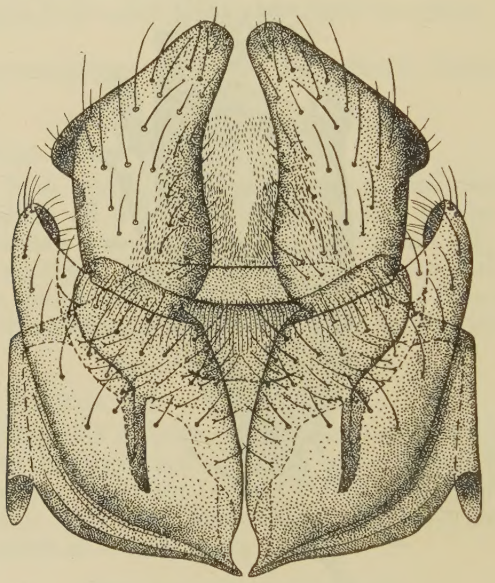

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Fig. 2.—*S. guianense*, male genitalia.

also bred from pupae found on the leaves of an aroid (*Dieffenbachia paludicola* N. E. Br. ex Gleason) in a forest creek in high forest near Mazaruni Settlement on the Essiquibo in September. Eggs were also found on these leaves.

The type is in the United States National Museum, Washington.

Simulium incrustatum Lutz.

1910, *Mem. Inst. Oswaldo Cruz* **2** : 243.

São Paulo, Brazil, is the type locality. It has also been recorded from Venezuela. The pupa has been figured by Pinto (1931) and the type is presumably in the Instituto Oswaldo Cruz. There are no specimens in the British Museum collection.

Simulium limbatum Knab.

1915, *Bull. ent. Res.* **6** : 280.

The original series of this species was collected on the Rupununi River by Dr. K. S. Wise in ix.1913. They were apparently taken along with specimens

of *S. amazonicum*. The type is now in the British Museum and there are three paratypes in the collection of the Wellcome Bureau of Scientific Research, London.

Simulium lugubre Lutz.

1928, *Estud. Zool. Parasit. venezol.* : 46 (Rio de Janeiro).

This species has only been recorded from Venezuela, Maracay, which is the type locality. Lutz gives figures of both the female and the pupal respiratory filaments. The British Museum collection does not contain any specimens.

The type material is presumably in the Instituto Oswaldo Cruz.

Simulium lutzianus Pinto.

1932, *Sept. Reun. Soc. Argentina Pat. Reg. Norte* **1931** : 748 (Buenos Aires).

This species from Venezuela was described by Pinto from the pupae alone. Pupae closely resembling those figured by Pinto (1932) were taken by me from a small stream in low bush, that had recovered from burning, on the savannah at the Kaieteur Fall in British Guiana, 6.ix.1937. The imagines had emerged; the pupae were attached to the grass-like leaves of a species of Cyperaceae trailing in the water.

Simulium metallicum Bellardi.

1859, *Saggio di Ditterologia Messicana* (1) : 14 (Torino).

This species has been recorded from Mexico, Costa Rica, Guatemala and Trinidad. The type locality is Mexico; the type may be in the Museum at Florence. The British Museum collection contains specimens from Mexico, Costa Rica and Trinidad (Port of Spain, ii.1912, and Mt. Harris, vii.1924). Also from Trinidad (Aripo, 28.ix.30) in London School of Hygiene and Tropical Medicine collection.

Simulium ochraceum Walker.

1860, *Trans. ent. Soc. Lond.* (n.s.) **5** : 332.

Originally described from Mexico, this species has since been recorded from Venezuela by Lutz (1928). The British Museum collection contains a series of specimens from Mexico but the type is lost. Also from Jamaica in London School of Hygiene and Tropical Medicine collection. There is some confusion in the literature as to the identity of this species.

Simulium paraguayense Schrottky.

1909, *Z. wiss. InsBiol.* **5** : 63.

The type locality of this species is Paraguay but it has also been recorded from Argentina, Brazil and Venezuela. The type is lost. The species is not represented in the collection of the British Museum.

Simulium perflavum Roubaud.

1906, *Bull. Mus. Hist. nat. Paris* **12** : 518.

Roubaud described this species from specimens collected by Dr. Lutz in São Paulo, Brazil. The British Museum collection contains a male labelled type and a second male labelled paratype.

Simulium placidum Knab.

1915, *Bull. ent. Res.* **6** : 281.

The only record of the occurrence of this species is that in Knab's description of the type, which with other specimens came from Trinidad, taken at the Arima

River on 31.xii.1913 by the late F. W. Urich. The British Museum collection includes the type and a series collected by me in Trinidad on the Naranja–Tucuchi Trail 30.x.1937 and on the Blanchisseuse Road at its junction with the upper end of the Verdant Vale Road, 31.x.1937, and in Tobago, Pigeon Peak at 1000 ft. 16.x.1937, and in the Forest Reserve on the Green Hill to Castara Rd. above 1000 ft. 18.x.1937.

The type is now in the British Museum. There are 2 paratypes in the collection of the Wellcome Bureau of Scientific Research.

Simulium quadrivittatum Loew.

1862, Dipt. Amer. Sept. II. *Berlin. ent. Z.* **6** : 186.

This species is recorded from Costa Rica, Porto Rico, Panama and Cuba, the last being the type locality. The British Museum collection contains material from Costa Rica (Orosi, i.1938), Jamaica and Panama Canal Zone. Also from Jamaica and Costa Rica (Sigrurres, 1.xii.1938 and Orisa, 1.vi.1938) in the London School of Hygiene and Tropical Medicine collection.

The type, if extant, may be in the Zoological Museum, Berlin.

Simulium rubrithorax Lutz.

1909, *Mem. Inst. Oswaldo Cruz* **1** : 132.

Serra da Bocaina and Batataes, Brazil, are the type localities of this species which has, however, also been recorded by Lutz (1928) from Venezuela. Lutz (1928) has figured the adult, the pupal respiratory organs and cocoon; Pinto (1932) has illustrated the cocoon.

A series of females and one male were taken by me attracted to light at the rest house at the Kaieteur Fall on the Potaro River on 6.ix.1937, on a dark night. A series of pupae was taken in a stream in the high forest on the trail from Tukeit to the top of the Kaieteur Fall at a point about 2 miles from the rest house. They were all, along with some larvae, on the sandstone bed of the stream. This stream must have been a veritable torrent in the rainy season but at the time of collecting the water was flowing over the sloping sandstone bed in a steady sheet without much force and in most places an inch to six inches deep. Attempts to rear these pupae failed but dissection of some of the more fully developed specimens revealed that the imagines belonged to a species with a yellow thorax and that, in certain other details which it was possible to check, they corresponded with the adult specimens of *S. rubrithorax* taken at the rest house. The cocoons corresponded exactly with the figures of Lutz and Pinto but the pupal respiratory organs have from 14 to 22 filaments (fig. 3). Lutz shows only 8 filaments in his figure. It may be noted, however, that the large number of filaments is due to branching of 7–11 main stems of the whole respiratory organ.

Apart from the series mentioned above there are no other specimens in the British Museum collection. The type is presumably in the Instituto Oswaldo Cruz.

Simulium samboni Jennings.

1915, *Proc. ent. Soc. Wash.* **17** : 199.

This species was reared from pupae taken in the Panama Canal Zone. There are no other records of its capture. The pupae were not described, and the type series, which contains both males and females, is in the United States National Museum, Washington. It is unrepresented in the British Museum collection.

Simulium sanguineum Knab.

1915, *Bull. ent. Res.* **6** : 279.

The only record of this species is from Colombia, where the type series was taken " biting man." The type is now in the British Museum. There is a paratype in the collection of the Wellcome Bureau of Scientific Research, London. The London School of Hygiene and Tropical Medicine collection has specimens from British Guiana. The British Museum collection contains specimens from British Guiana (R. Essesquibo–Rupununi, Apotari, 9.x.1926; Thanami Creek, 400 miles from Coast, 1908). The collector noted that it was biting in the last locality and was known by the native name of " Itan." Finally there are specimens from Panama (Darien Province, 29.i.1933 and Chucunaque R., 7.ii.1933).

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Fig. 3.—*S. rubrithorax*, pupa.

Simulium subnigrum Lutz.

1910, *Mem. Inst. Oswaldo Cruz* **2** : 239.

The type locality for this species is Brazil but it has also been taken in Venezuela. Pinto (1932) has figured the pupal respiratory organ. The British Museum collection contains a series of specimens taken by me in Trinidad at the summit of the Blanchisseuse Road, 31.x.1937.

The type is, presumably, in the Instituto Oswaldo Cruz.

Simulium tarsale Williston.

1896, *Trans. ent. Soc. Lond.* **29** : 268.

Williston described this species from 3 females taken in St. Vincent. The material described in the paper in which the species was described came to the British Museum but no trace can be found of the types of this species of *Simulium*; nor does the collection contain any other specimens. One or

more of them may, perhaps, be in some part of Williston's collections in the United States of America.

Simulium versicolor Lutz.

1928, *Estud. Zool. y Parasitol. venezol.* : 47 (Rio de Janeiro).

Lutz figured both the adult female and the pupal respiratory organs in his description of this species which comes from Venezuela, and has not, so far, been recorded from any other place. It is unrepresented in the British Museum collection.

The type is, presumably, in the Instituto Oswaldo Cruz.

Bibliography.

The following is a list of the more comprehensive papers dealing with Central and South American Simuliidae. It does not include all papers in which there are references to, or descriptions of, Simuliidae, but by using these papers as sources it should be possible to trace down all the literature.

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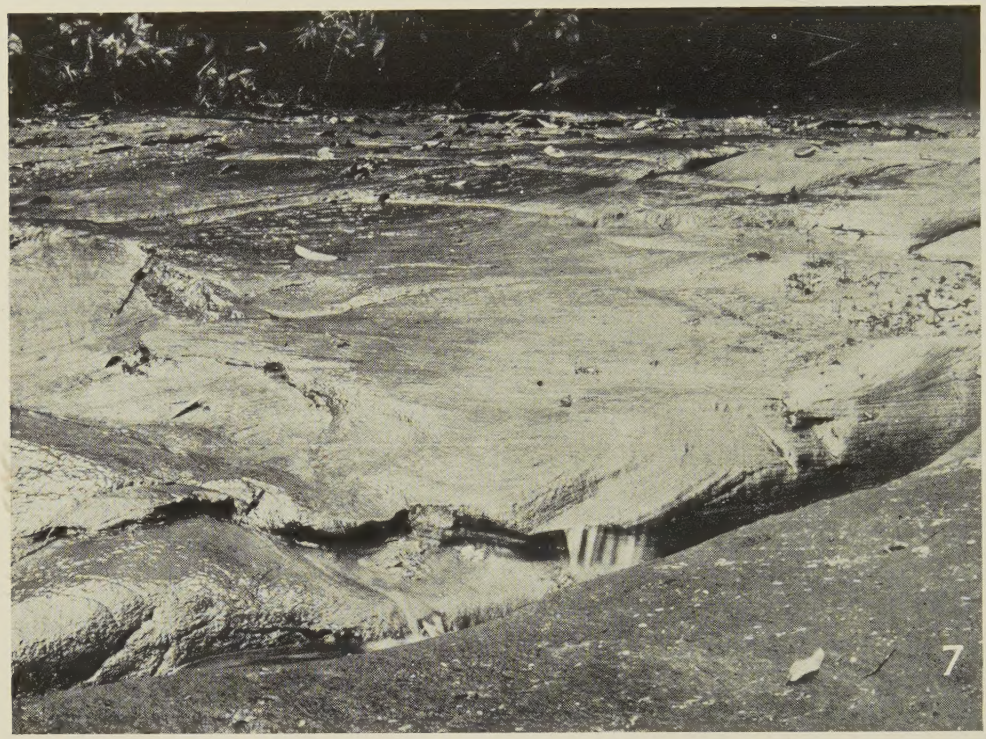

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PLATE 1.

FIG. 1. Habitat of *Simulium guianense* Wise. The top of the Kaieteur Fall on the Potaro River, British Guiana. The river is about 300 feet across at this point and the fall some 740 feet in height.

2. Habitat of *Simulium guianense* Wise. Podostemaceae growing on the rocks at the lip of the Kaieteur Fall.

PLATE 2.

FIG. 3. Habitat of *Simulium guianense* Wise. Amatuk Fall (Rapid) on the Potaro River, British Guiana.

4. Habitat of *Simulium guianense* Wise. Podostemaceae growing on the rocks in the Potaro River at Amatuk Fall.

PLATE 3.

FIG. 5. Habitat of *Simulium guianense* Wise. Warratuk Fall (Rapid) on the Potaro River, British Guiana.

6. Habitat of *Simulium lutzianus* Pinto. Small stream in bush that had recovered from burning on the Savannah at Kaieteur Fall, British Guiana.

PLATE 4.

FIG. 7. Habitat of *Simulium rubrithorax* Lutz. The sandstone bed of stream in high forest near Tukeit on the Potaro River, British Guiana. The water level was very low at the time when the specimens were collected.

8. Habitat of *Simulium haematopotum* Malloch. "Brown water" creek in the high forest near Mazaruni Settlement, British Guiana.